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THE PREVENTION

OF

Cholera Infantum and Kindred Diseases,

AND OF

POISONING BY CHEESE, MILK, ETC.

ABSTRACT OF A PAPER ON THE CHEMISTRY OF TYROTOXICON,
ITS ACTION UPON LOWER ANIMALS, AND ITS RELATION
TO THE SUMMER DIARRHEAS OF INFANCY.

By VICTOR C. VAUGHAN, M. D., Ph. D.,

PROFESSOR OF PHYSIOLOGICAL CHEMISTRY IN THE UNIVERSITY OF
MICHIGAN, AND MEMBER OF THE STATE BOARD OF HEALTH.

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[At the meeting of the State Board of Health, April 12, 1887, Dr. Vaughan made a report on tyrotoxinon, the poison which he has found in poisonous cheese, milk, ice cream, and oysters. His full report will appear in the annual report, in advance of which this abstract is published by the State Board of Health, for the information of the people.]

Since the last report in regard to tyrotoxinon,* it has been ascertained that if some butyric acid ferment be prepared as is ordinarily done in the preparation of butyric acid, and some of this be added to normal milk, and the whole be kept in closely stoppered bottles for 8 or 10 days, the poison will be developed in the milk in considerable quantity. The milk should be filtered, the filtrate neutralized with sodium carbonate, and then extracted with ether.

Having a strong solution of the poison in absolute alcohol, which had been obtained from milk inoculated as stated above, we added to it some platinum chloride and began to evaporate on the water-bath. As soon as the alcohol evaporated, the residue exploded with great violence. This experiment was repeated a number of times with like results. From some of this alcoholic solution, the platinum was removed with hydrogen sulphide gas; but the filtrate was then found to have lost its explosive property. This reminded us that diazobenzol compounds form with platinum chloride a highly explosive compound, and that these are also decomposed by hydrogen sulphide. Some diazobenzol nitrate was prepared according to the method of Griess, and comparisons made between this and tyrotoxinon.

* Proceedings of State Board of Health of Michigan, Oct., 1886, and annual report of the same board, pp. 154-164.

[Here are given in detail the chemical experiments and experiments with animals, by which the identity of tyrotoxinon with diazobenzol is established.]

I think it highly probable that diazobenzol, or some closely allied substance, will be found in all those foods which from putrefactive changes produce nausea, vomiting, and diarrhea. In some oysters which produced these symptoms, I have recently found tyrotoxinon.

Tyrotoxinon and Cholera Infantum and Like Affections.

The experiments upon animals (which are given in the full paper to be published in the annual report of the State Board of Health) convince me that the development of tyrotoxinon in milk is a frequent cause of cholera infantum and kindred affections. When we remember that these diseases are most prevalent among the poor classes of our large cities where fresh milk is almost unknown, we can readily understand their frequency. By such people milk is often not obtained until it has begun to sour, then it is kept at a high temperature and often in a most foul atmosphere, and we all know something of the readiness with which milk takes up bad odors. This milk is then eaten by the little ones who are weakened by poverty and everything that poverty means, insufficient food generally, and that of the poorest quality, insufficient clothing, insufficient and vitiated air. With these facts before us, it is not surprising that in all our large cities thousands of children die annually from the summer diarrheas. Moreover, in our country places, how little attention is given to the food of children, we all know from actual observation. Cows stand and are milked in filthy barns and yards. The udders are generally, so far as my observation goes, not washed before the milking; the vessels for the milk are frequently found not as clean as they should be. Then there are the thousands of children that must draw their sustenance from bottles, the cleansing of which is in many families not properly attended to. Crusts of decomposing milk form around the neck of the bottle, in the tube and nipple, and lead to the rapid decomposition of the entire contents of the bottle. I think that one of the most important advantages to be secured to breast-fed children arises from the lessened danger of infection of the milk with germs which may produce poisonous ptomaines.

I would not claim that decomposed milk is the sole cause of the summer diarrheas of children, nor would I claim that tyrotoxinon is the only poison that may be developed in milk. It is only one of a large class of bodies which are produced by putrefaction, and many of these are cathartic in action.

Rules for the Prevention of the Development of Tyrotoxinon in Milk.

1. The cows should be healthy and the milk of any animal which seems indisposed should not be mixed with that from the perfectly healthy animals.
2. Cows must not be fed upon swill, or the refuse of breweries or glucose factories, or any other fermented food.
3. Cows must not be allowed to drink stagnant water; but must have free access to pure, fresh water.

4. Cows must not be heated or worried before being milked.
5. The pasture must be free from noxious weeds, and the barn and yard must be kept clean.
6. The udder should be washed, if at all dirty, before the milking.
7. The milk must be at once thoroughly cooled. This is best done by placing the milk can in a tank of cold spring water or ice-water, the water being of the same depth as the milk in the can. It would be well if the water in the tank could be kept flowing; indeed, this will be necessary unless ice-water is used. The tank should be thoroughly cleaned every day to prevent bad odors. The can should remain uncovered during the cooling, and the milk should be gently stirred. The temperature should be reduced to 60° F. within an hour. The can should remain in the cool water until ready for delivery.
8. In summer, when ready for delivery, the top should be placed on the can and a cloth wet in cold water should be spread over the can, or refrigerator cans may be used; at no season should the milk be frozen, but no buyer should receive milk which has a temperature higher than 65° F.
9. After the milk has been received by the consumer, it should be kept in a perfectly clean place, free from dust, at a temperature not exceeding 60° F. Milk should not be allowed to stand uncovered, even for a short time, in sleeping or living rooms. In many of the better houses in the country and villages, and occasionally in the cities, the drain from the refrigerator leads into a cesspool or kitchen drain. This is highly dangerous; there should be no connection between the refrigerator and any receptacle of filth.
10. The only vessels in which milk should be kept are tin, glass or procelain. After using the vessel, it should be scalded and then, if possible, exposed to the air.

Prevention of Summer Diarrheas.

But in the prevention of the summer diarrheas, attention to the food must not stop with its introduction into the body. The ferment which produces tyrotoxinon is widely distributed, and it only awaits conditions suitable for its development. We do not know exactly what germ it is that produces this poison; but it is either the butyric acid ferment, or some ferment which is frequently developed along with the *bacillus butyricus*, because I have found that if some butyric acid ferment be prepared according to the method usually followed in making butyric acid, and milk be inoculated with this and allowed to stand at the temperature of the body for a few hours, or at the ordinary temperature of the room for several days, the poison will appear. Moreover, as is well known, the *bacillus butyricus* grows best in the absence of air. We have already seen that the exclusion of air favors the development of tyrotoxinon. We are aware of the fact that the butyric acid ferment frequently does develop in the stomach. Therefore, I think that the prevention of these diseases necessitates some attention to digestion. If the food lies in the stomach or intestine undigested, putrefactive changes will occur there.

During the hot months, children who are allowed to take food at will often drink large quantities of milk simply for the purpose of quenching thirst. I feel that this overloading the stomach with milk, caused by thirst, often is of no little detriment. It is hardly necessary to specify in regard to other ways in which attention should be given to the digestive organs of children.

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Those that partake of other foods with their milk should be allowed only the most wholesome articles, and these should be in the most perfect condition. Moreover, the depressing effects of extreme heat on the nervous system and its consequent injury to digestion should always be borne in mind.

What to do When Summer Diarrheas Occur.

The first thing to do is to stop the administration of milk in any form. The ferment is present in the alimentary canal and giving the best of milk would simply be supplying the germ with material for the production of the poison. This no-milk treatment is not by any means a new idea; but the reason for it has not been hitherto understood. Now that we know that a powerful poison is formed from the putrefaction of milk, the necessity of its exclusion must become apparent to all.

[Here Dr. Vaughan quotes from one of his former reports on tyrotoxicon,* an account of a case of cholera infantum due to tyrotoxicon in milk. It occurred in his own practice, and admirably illustrates the necessity of withholding milk in such cases.]

The food used may consist of chicken and mutton broths, beef juice, and rice or barley water. With this list no difficulty will be experienced in giving the child sufficient nourishment.

From the Maryland Medical Journal, June 25, 1887.

“Three years ago Prof. Vaughan discovered in poisonous cheese a ptomaine which produced nausea, vomiting and diarrhea. Later this same poison was found in ice cream and in milk. Chemically this poison is known as diazobenzol, which may be made artificially by the action of nitrous acid gas at a low temperature upon the nitrate, butyrate, or other salt of anilin. It is decomposed when heated to near the boiling point. It is developed in milk by the growth of a germ, which multiplies very rapidly when the conditions are favorable. The favorable conditions consist principally of exclusion of air, or the presence of a limited supply of air, and a comparatively warm temperature, the germ developing most rapidly at about 98° F. Uncleanliness increases the tendency of milk to decompose, and the improper feeding of the cow tends to produce the same putrefactive changes.

“From one grain to one and a half grains of this poison administered to cats causes death within two hours. The administration of smaller doses leads to vomiting, diarrhea, rapid emaciation, and death from exhaustion. ‘In other words,’ says Professor Vaughan, ‘it establishes a cholera infantum condition.’”

*Proceedings of the State Board of Health of Michigan, October, 1886, p. 4; and the annual report of same board for 1886, p. 163.